

# Northeast Coastal and Barrier Network

National Park Service  
U.S. Department of the Interior

Northeast Coastal and Barrier Network



Old Inlet, Before Hurricane Sandy



Old Inlet, After Hurricane Sandy

The storm surge from Hurricane Sandy caused several breaches, or breaks, in barrier islands managed by the National Park Service, including this one at Old Inlet in Fire Island National Seashore in New York.

## Elevation Mapping Helps Build Resilient Coastal Communities

When Hurricane Sandy hit the east coast of the United States on October 29, 2012, it battered coastal towns with heavy winds and a storm surge of up to 14 feet. The storm displaced more than 23,000 people and decimated critical infrastructure. With damages exceeding more than \$68 billion, Sandy was the second most costly storm in U.S. history.

Many National Park Service sites were impacted by Hurricane Sandy—including three major coastal parks, Fire Island National Seashore, Gateway National Recreation Area, and Assateague Island National Seashore—and future coastal storm damage seems likely. While Hurricane Sandy exacted huge financial and personal costs in coastal parks and communities, it offered an important lesson, serving as a devastating reminder of how vulnerable coastal areas are to storms and sea level rise.

The threat is heightened in the mid-Atlantic U.S., where unique geology and a combination of climatic forces have accelerated the rate of sea level rise. Dubbed the Atlantic “hot spot,” the stretch of coastline from Cape Hatteras, North Carolina to Boston, Massachusetts—an area that contains all eight parks in the Northeast Coastal and Barrier Network—saw rates of sea level rise increase three to four times faster than the global average

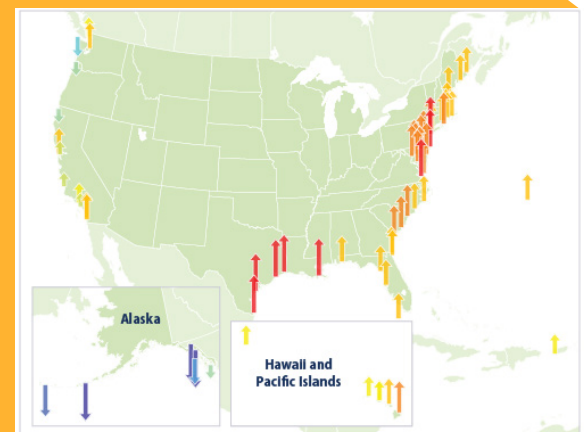
between 1980 and 2009, according to a U.S. Geological Survey report. This makes coastal storm response an especially urgent management issue in the mid-Atlantic region.

Coastal elevation mapping is essential to making informed decisions in response to threats to public safety, property, and critical natural resources like marine fish, mammals, and birds. By better understanding past storms and modeling future scenarios, elevation data helps communities protect themselves from future storms and rising seas.

In the wake of its damage, Hurricane Sandy triggered major investment in collaborative research to prevent future devastation from coastal storms. Through elevation mapping, researchers collect critical data that informs sound park management and increases coastal resilience.



Maintenance facilities at Fort Hancock, located in the Sandy Hook Unit of Gateway National Recreation Area, were underwater and only accessible by boat after Hurricane Sandy.

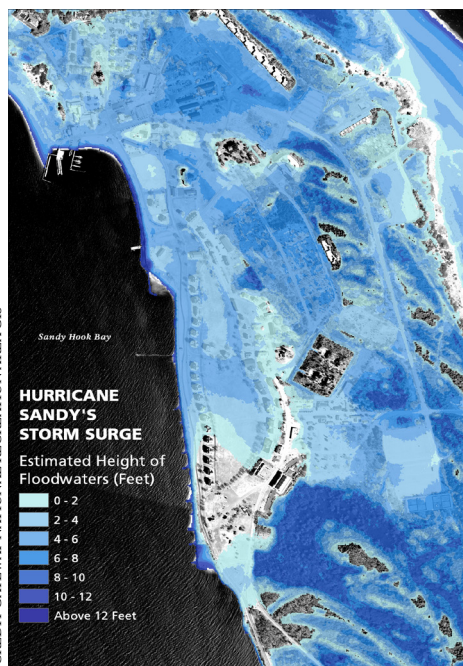


Relative sea level change along U.S. coasts, 1960-2013.

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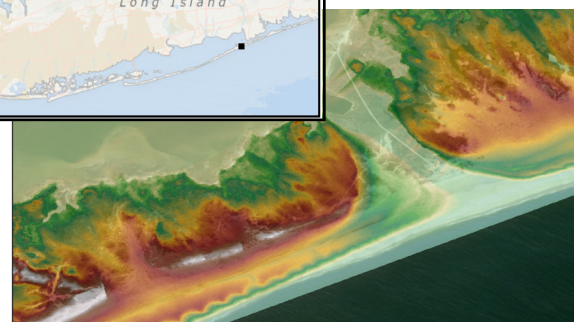
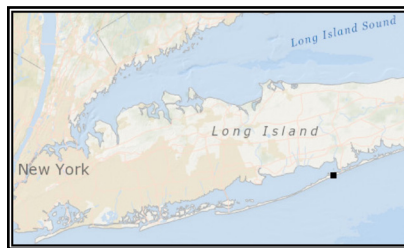
## What is elevation data?

A location's height above sea level is called its elevation. Elevation data are calculated using either a standard reference point (a "geodetic datum") or measurements from local tide gauges ("tidal datums"). Researchers measure the elevation of specific points along our coastlines and gather this data to create sophisticated maps of current elevation.

Left: Hurricane Sandy's impact on Gateway National Recreation Area. Blue areas were underwater during Sandy's storm surge.

## Why do elevation maps matter?

Using elevation maps, researchers can illustrate the on-the-ground impacts of future sea level rise and storm surge scenarios, so coastal communities can make informed decisions about development and emergency response.



Above: LiDAR image of the Old Inlet breach at Fire Island National Seashore caused by Hurricane Sandy. Color imagery shows post-storm elevation.

### Examine past damage

Map the impact of storm surges on natural and built environments.

Assess damage to natural and economic resources.

Clarify protection and restoration priorities.

### Model future scenarios

Map likely damage from storms and sea level rise.

Forecast flooding and water flow at precise points, like highways or hospitals.

Predict impacts on coastal habitats and wildlife.

### Plan effective storm response

Monitor change in vulnerable coastal areas.

Inform local governments about predictable shoreline changes.

Contribute to the creation of sound protective strategies in coastal zones.

## How do researchers map our coasts?

Tide gauges measure sea level through complex instruments located along our coasts. They're essential for creating accurate elevation maps.

Precision Global Positioning System (GPS) Receivers provide measurements of height, accurate to within centimeters, that scientists use to map the topography of the coast.

Light Detection and Ranging (LiDAR) instruments emit laser light pulses from airplanes. The pulses are reflected back to sensors to measure the elevation of the ground or water below. LiDAR provides rapid elevation mapping over large areas.

Aerial photographs allow researchers to observe changes to coastlines.



National Park Service and University of Rhode Island staff carry rover units through Assateague Island National Seashore. These rovers communicate with GPS base stations to record elevation data in park salt marshes.

## Why do we need tide gauges?

Depending on the tide, even roads and homes that are currently 10 feet above local sea level could be underwater in a 14-foot storm surge like the one some areas experienced with Hurricane Sandy. Tide gauges record information about the precise patterns of rising and falling tides up and down our coastlines. Without data from tide gauges, researchers would not be able to make predictions about storm impacts in specific communities. Hurricane Sandy damaged or destroyed 73 tide gauges on the U.S. east coast, leaving researchers with critical information gaps. Replacement of these gauges is necessary for accurate measurement of the vulnerability of coastal resources to inundation (rising water from sea level rise and storm surges).



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university of rhode island  
**SEAcmm**  
society, ecology & communication laboratory

Jamie Remillard, Caroline Gottschalk Druschke, and Kelly Canesi  
Acquisition, Coordination, Compilation, Data Management and Change Analysis of LiDAR and  
Other Geospatial Data Collected Pre- and Post-Hurricane Sandy  
Task Agreement P13AC00875 of Cooperative Agreement Number P09AC00212